

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Currently Amended) A method for controlling the liquid-phase fuel penetration distance of fuel in an engine adapted to operate in a plurality of combustion modes and having direct fuel injection into a combustion chamber of the engine, said combustion chamber having predefined interior surfaces and said method comprising:

providing a source of liquid fuel for said engine;

injecting fuel from said source of liquid fuel through at least one injector into the combustion chamber of the engine;

determining at least one contemporary operating parameter of the engine;

determining a desirable combustion mode based on the determined contemporary operating parameter of the engine;

determining a desirable liquid phase penetration distance for fuel injected into the combustion chamber of said engine at which fuel impingement on said predefined interior surfaces of the combustion chamber is minimized, said desirable liquid phase penetration distance being based on said determined desirable combustion mode and said at least one contemporary operating parameter of the engine;

controllably heating fuel provided by said source of liquid fuel prior to injection into the combustion chamber of said engine and altering the liquid-phase penetration distance of said fuel into the combustion chamber of said engine in response to the determined desirable liquid phase

penetration distance for liquid fuel injected into the combustion chamber of said engine.

2. (Currently Amended) The method, as set forth in Claim 1, wherein said determining at least one operating parameter of the engine includes determining at least one contemporary operating parameter of the engine selected from the group consisting of fuel composition, fuel injector geometry, fuel injection pressure, [combustion mode]engine speed, engine load, and thermodynamic conditions existent in the combustion chamber of said engine.

3. (Currently Amended) An apparatus for controlling liquid-phase fuel penetration distance in an engine adapted to operate in a plurality of combustion modes and having direct fuel injection into a combustion chamber [of the engine,]having predefined interior surfaces, said apparatus comprising:

a source of liquid fuel in fluid communication with the combustion chamber of said engine;

a programmable electronic controller adapted to generate a fuel temperature control signal correlative of a desired combustion mode based on at least one contemporary operating parameter of said engine; and,

a means for controllably heating said liquid fuel prior to injection into the combustion chamber of said engine to a temperature at which fuel impingement on said predefined interior surfaces of the combustion chamber is minimized in response to said fuel temperature control signal, said means being disposed between said source of liquid fuel and said combustion chamber of the engine and in thermal communication with said liquid fuel prior to injection into the combustion chamber of the engine.

4. (Currently Amended) The apparatus, as set forth in Claim 3, wherein the fuel temperature control signal correlative of at least one contemporary operating parameter of said engine is correlative of at least one contemporary operating parameter of the engine selected from the group consisting of fuel composition, fuel injector geometry, fuel injection pressure, [combustion mode]engine speed, engine load, and thermodynamic conditions existent in the combustion chamber of said engine.

5. (Original) The apparatus, as set forth in Claim 3, wherein said means for controllably heating said liquid fuel prior to injection into the combustion chamber of said engine includes an electrical resistance heater in thermal communication with said liquid fuel.

6. (Currently Amended) The apparatus[], as set forth in Claim 3, wherein said apparatus includes a temperature sensor in electrical communication with said programmable electronic controller and adapted to measure the temperature of heated liquid fuel prior to injection into the combustion chamber of said engine.